

What is claimed is:

1. Mass filter apparatus for filtering a beam of ions having mass/charge ratios in a range of mass/charge ratios to transmit ions of a selected mass/charge ratio in [the] said range, comprising:

an ion beam source for emitting the ion beam,
first and second mass filter stages in series to receive the beam from the beam source, and a vacuum system arranged to maintain both the first and second filter stages at operating pressures below 10^{-3} torr;

wherein the first mass filter stage is configured to select for transmission on to the second filter stage only ions having a sub-range of mass/charge ratios which includes the selected mass/charge ratio, and

the second mass filter stage is configured to select only ions of [the] said selected mass/charge ratio.

2. An apparatus according to claim 1, wherein the ions within the sub-range comprise 1%, or less, of the ions within the beam.

3. An apparatus according to claim 1, wherein the ions within the sub-range comprise 0.01%, or less, of the ions within the beam.

4. An apparatus according to claim 1, wherein each filter stage comprises a multi-pole [analyser] *analyzer*.

5. An apparatus according to claim 4, wherein each filter stage comprises rods in a quadrupole arrangement.

6. An apparatus according to claim 4, further comprising a DC voltage supply and an AC voltage supply for applying [a] driver [voltage] *voltages* to [the] rods of each filter stage.

7. An apparatus according to claim 4, wherein an AC voltage supply is connected to one of the filter stages and another filter stage is electrically coupled to the one filter stage by an [RE] *RF* coupler.

8. An apparatus according to claim 1, further comprising a scanner for controlling [at least] the second filter stage so that the mass/charge ratio of transmitted ions is scanned over a scanned range to provide a mass spectrum.

9. An apparatus according to claim 8, wherein the scanner is arranged to control also the first filter stage so that a [centre] *center* point of the sub-range of mass/charge ratios transmitted by said first filter stage substantially tracks the scanned mass/charge ratio transmitted by the second filter stage.

10. An apparatus according to claim 1, wherein the first filter stage is arranged off axis with respect to the second filter stage.

11. An apparatus according to claim 10, wherein the longitudinal axis of the first filter stage is arranged to intersect with the longitudinal axis of the second filter stage substantially at the end of the second filter stage nearest to the first filter stage.

12. Mass spectrometer comprising a mass filter apparatus according to claim 1.

13. A method for filtering a beam of ions having mass/charge ratios within a range of mass/charge ratios to transmit ions of a selected mass/charge ratio in [the] said range, the method comprising:

emitting the ion beam from a beam source into a first mass filter stage that is arranged in series with a second mass filter stage;

selecting at the first mass filter stage for transmission on to the second mass filter stage only ions having a sub-range of mass/charge ratios which includes the selected mass/charge ratio; and

selecting at the second mass filter stage only ions having the selected mass/charge ratio,

wherein the first and second filter stages operate at pressures below 10^{-3} torr.

14. A method according to claim 13, wherein the ions within the sub-range comprise 1%, or less, of the ions within the beam.

15. A method according to claim 13, wherein the ions within the sub-range comprise 0.01%, or less, of the ions within the beam.

16. A method according to claim 13, wherein each filter stage comprises a multi-pole mass filter, and [a] DC and AC driver [voltage is] *voltages are* applied to the filter.

17. A method according to claim 16, wherein an AC voltage is supplied to one filter stage and another filter stage is electrically coupled to the first filter stage by an RF coupler.

18. A method for producing a mass spectrum of an ion beam having mass/charge ratios within a range of mass/charge ratios, comprising:

emitting the ion beam from a beam source into a first mass filter stage,

selecting only ions having a sub-range of mass/charge ratios which includes a selected mass/charge ratio at the first mass filter stage for transmission on to a second mass filter stage arranged in series with the first mass filter stage,

selecting only ions having the selected mass/charge ratio at the second mass filter stage for transmission on to a detector for detecting any ions having the selected mass/charge ratio,

controlling [at least] the second filter stage so that the selected mass/charge ratio is scanned over a scanned range, and

detecting the number of ions selected by the second filter stage at any given mass/charge ratio to provide a mass spectrum,

wherein the first and second filter stages operate at pressures below 10^{-3} torr.

19. A method according to claim 18, further comprising controlling the mass/charge of ions selected by the first filter stage so that a [centre] *center* point of the sub-range of mass/charge ratios selected by said first filter stage substantially tracks the selected mass/charge ratio during scanning of the selected mass/charge ratio by the second filter stage.

20. A method according to claim 18, wherein the ions within the sub-range comprise 1%, or less, of the ions within the beam.

21. A method according to claim 18, wherein the ions within the sub-range comprise 0.0 1%, or less, of the ions within the beam.

22. A method according to claim 18, wherein each filter stage comprises a multi-pole mass filter, and [a] DC and AC driver [voltage is] *voltages are* applied to the filter.

23. A method according to claim 22, wherein [an] *the* AC voltage is supplied to one filter stage, and *wherein* another filter stage is electrically coupled to the first filter stage by an [RE] *RF* coupler.

24. A method according to claim 22, wherein a scanner controls *amplitudes of* the AC and DC [voltage amplitudes] *voltages* over a voltage range, and the AC:DC voltage ratio [constant] is kept substantially constant.

25. A method for filtering ions with a given mass/charge ratio from a beam of ions having an array of mass/charge ratios, in a mass spectrometer comprising an ion beam source for emitting the ion beam, a detector or output for detecting or transmitting the filtered ions, and a plurality of mass filters disposed in series between the beam source and the detector or output, the filters having the same operating pressures at or below 10^{-3} torr, the method comprising:

emitting the ion beam from a beam source into a first mass filter,